Houston Mobile Stroke Unit

James C. Grotta MD
Director, Mobile Stroke Unit Consortium
Clinical Innovation and Research Institute
Memorial Hermann Hospital-TMC
Houston, Texas
Why does stroke matter?

- Stroke is the 4th leading cause of death in the U.S.
- Every year, more than 795,000 people in the United States have a stroke.
- One stroke every 40 seconds in the U.S.
- Stroke costs the United States an estimated $38.6 billion each year in health care services, medications, and missed days of work.
- Stroke is the leading cause of serious long-term disability.

http://www.cdc.gov/stroke/facts.htm
Stroke causes as much disability and more deaths than all other neurological conditions combined.

Disability

Death
Exponential effect of time in the first hour

Kim et al, 11/4/16

Hermes investigators. JAMA 2016;316:1279-88
MSUs are the only way to bring stroke treatment into the first hour where it may have an exponential benefit.

Data from 622 patients. Odds ratio of minimal or no disability at 3 months for rt-PA compared to placebo-treated patients, with 95% confidence interval (--). Range of times from 58 to 180 minutes. Mean time to treatment ($\mu$) was 119.7 minutes.
Nation's first mobile stroke unit to bring ER to Houston patients
Mobile Stroke Units Don’t Need to be Fancy

- Standard 12 foot ambulance
- Portable CT scanner
- Point-of-care laboratory
- Tele-radiology & neurology
- VN, RN, CT tech, Medic
Involving all community stakeholders was essential

- Houston Mobile Stroke Treatment Unit Consortium
  - HFD-EMS
  - All Comprehensive Stroke Centers (MHH, Methodist, Baylor-CHI)
  - Patients; Patient-Stakeholder Advisory Sub-Committee

- Philanthropic support: Jim McIngvale, HEB, Frazer, individual donors
MSU process is simple--but requires coordination with EMS and local hospitals

1. 911 call
2. EMS ambulance immediately dispatched per routine
3. MSU team dispatched to site
4. MSU team meets EMS ambulance at emergency site
Methods

• Quick screening evaluation by the VN, nurse and paramedic on scene.
• Pt loaded into MSU and further Hx, VS and Labs obtained
Methods

• CT viewed by OB-VN, or
• CT sent to cloud-based PACS for TM-VN viewing
• OB-VN or TM-VN completes their evaluation and makes tPA decision
The on board MD can be replaced by a TM MD

Satisfactory connectivity
169/173 (98%) of MSU consults

Agreement between On-Board and TM VN
88% (Kappa = 0.73) (compared with in-person agreement in ED of 88%)


- TM VN and On Board VN on all MSU runs
- Evaluate the patient together on board the MSU
- Make rtPA decision independently
- Test Reliability of TM and Agreement on decision
“(B) INCLUSION OF CERTAIN SITES.—With respect to telehealth services described in sub-paragraph (A), the term ‘originating site’ shall include any hospital (as defined in section 1861(e)) or critical access hospital (as defined in section 1861(mm)(1)), any mobile stroke unit....”
There are false alarms but good communication minimizes wasted effort

- One shift/day 8am-6pm since 9/1/14
- 20-25 alerts/wk
- 2/5 disregarded enroute
- 2/5 screened out on-site
- 1/5 tPA eligible and transported (675 “transports” as of 1/1/18)
  - 60% treated with tPA (2.5/wk)
  - others excluded b/o:
    - ICH
    - TIA/improvement
    - Other new information
    - Seizure, other mimic
MSU on scene time = EMS transport time,

HFD average on scene 15-17 minutes
HFD transport time to a CSC 2-30 minutes
Mobile Stroke Unit avg on scene 21-25 minutes

SO
We save the entire ED door to needle time

DTN 60 min
Patients DO get treated much faster

<table>
<thead>
<tr>
<th>Distance from base-station (miles)</th>
<th>6.7</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSN to tPA time (minutes)</td>
<td>98 (47-265)</td>
</tr>
<tr>
<td>% going for thrombectomy</td>
<td>30%</td>
</tr>
<tr>
<td>Time to groin puncture</td>
<td>70 min faster than RCTs</td>
</tr>
</tbody>
</table>

33% < 60 min from LSN
33% 60-80 min from LSN
A Breakthrough Stroke Treatment Can Save Lives—If It’s Available

The ‘thrombectomy’ is transforming stroke care, pre-empting brain damage in many patients, but the medical establishment is far from making it standard practice

By Thomas M. Burton
ONSET TO GROIN PUNCTURE IN MSU PATIENTS

Studies
SPECIFIC AIMS

1. How much less disability at 3 months?
2. Cost-Effectiveness – pts followed up to 1 yr
BEST-MSU Study Process

911 call
EMS ambulance immediately dispatched per routine
MSU team dispatched to site
MSU team meets EMS ambulance at emergency site

Alternating weeks 8 am- 6 pm
Non MSU weeks, nurse dispatched without MSU to ensure same data and comparable patients
TMC vs West Side
### 5 yr Cost/Effectiveness Analysis

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost (1999 dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of CT Scanner</td>
<td>$400,000</td>
</tr>
<tr>
<td>Ambulance /Chassis/ALS Equip</td>
<td>$600,000</td>
</tr>
<tr>
<td>TM equipment</td>
<td>$30,000</td>
</tr>
<tr>
<td>Other Stuff</td>
<td>$70,000</td>
</tr>
<tr>
<td>Operating Costs X 5 yrs</td>
<td>$500,000</td>
</tr>
<tr>
<td>Staff: Paramedic/EMT/Nurse and TM MD X 5 yrs (1 shift/d)</td>
<td>$2,000,000</td>
</tr>
<tr>
<td><strong>Total fixed and continuing costs for 1 MSTU X 5 yrs</strong></td>
<td><strong>$3,600,000</strong></td>
</tr>
</tbody>
</table>

Lifetime direct cost per stroke (1999 dollars) $140,000 \[(Circulation. 2009;119:e21-e181)\]

Therefore, cost neutral if:

1 MSU results in 5 more patients/yr completely recovering
## 5 yr Pro Forma—HFD EMS

### Costs:
- Cost of CT Scanner X 3 MSUs: $1,200,000
- Ambulance/Chassis/ALS Equip X 3 MSUs: $1,800,000
- TM equipment X 3 MSUs: $100,000
- Other Stuff X 3 MSUs: $210,000
- Operating Costs X 5 yrs X 3 MSUs: $1,500,000
- Staff: Paramedic/EMT/Nurse and TM MD X 5 yrs (2 shifts/d) X 3 MSUs: $12,000,000

**Total fixed and continuing costs for 3 MSUs X 5 yrs**: $16,810,000

### Revenue
- Transports (2 shifts, 3 MSTUs = 10/d @ $500 ea): $9,125,000

**To break even, reimbursement would have to increase from $500 to $921/transport**
13 current MSUs cover 3% of all strokes in the US
Rockport Texas, Sept 5, 2017
Post Hurricane Harvey
Biggest barrier to acute stroke treatment

Failure to alert

Public education

Let’s harness technology

Fitbit to recognize at fib

Wearable clothes to detect hemiparesis
So….what are we going to do with the MSU program once the study is over in 2019?

1. Establish a medicare billing code for MSU TM physician consultation
2. Establish a billing code for tPA on the MSU
3. Ask TMC stroke centers to share the costs of continued MSU operations ~$500,000/yr
4. Lobby CMS for higher reimbursement for MSU transport